



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

13.2

Memorandum

Date 14 April 1993

From Gregory D. Thomas
ATSDR Region 10

Subject Preliminary Public Health Assessment
Vancouver Water Station #4

To See Below

Enclosed is a copy of the final Preliminary Public Health Assessment for the Vancouver Water Station #4 site. This report was prepared by the Washington State Department of Health under cooperative agreement with ATSDR. While this is considered a final document, ATSDR will update or modify this Assessment as new information becomes available that effect the conclusions or recommendations it contains.

If you have any questions or comments please feel free to contact this office at (206) 553-2113.

Sincerely,

Gregory D. Thomas
Senior Regional Representative

Attachment

cc: Deborah Yamamoto, EPA
John Lauderback, SW Health District
John Ostrowski, Vancouver Public Works
David Hastings, Sierra Club
Dean Deonier, Clark County Hazardous Waste
John Karpinski, Clark County Natural Resource Council
Tom Taylor, Fort Vancouver Library

13.2

42268



PRELIMINARY PUBLIC HEALTH ASSESSMENT

VANCOUVER WATER STATION NO. 4 CONTAMINATION AREA

VANCOUVER, CLARK COUNTY, WASHINGTON

CERCLIS NO. WAD988475158

Prepared by

Washington State Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

*Agency for Toxic Substances
and Disease Registry.....William L. Roper, M.D., M.P.H. Administrator
Barry L. Johnson, Ph.D., Assistant Administrator*

*Division of Health Assessment
and Consultation.....Robert C. Williams, P.E., Director
Juan J. Reyes, Deputy Director*

Federal Programs Branch.....Sally L. Shaver, Chief

Community Health Branch.....Cynthia M. Harris, Ph.D., Chief

Remedial Programs Branch.....Sharon Williams-Fleetwood, Ph.D., Chief

Records & Information Management Branch.....Max M. Howie, Jr., Chief

Emergency Response & Consultation Branch.....C. Harold Emmett, P.E., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services

Additional copies of this report are available from:
National Technical Information Service, Springfield, VA
(703) 487-4650

TABLE OF CONTENTS

SUMMARY	1
BACKGROUND	2
A. Site Description and History	2
B. Site Visit	3
C. Demographics, Land Use, and Natural Resource Use	3
D. Health Outcome Data	5
COMMUNITY HEALTH CONCERNS	5
ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS	6
A. On-Site Contamination	6
1. Groundwater - Vancouver Water Station No. 4 Wells	6
B. Off-Site Contamination	7
1. Groundwater	7
2. Surface Water	8
3. Soil-gas	9
4. Soil	10
C. Quality Assurance and Quality Control	11
D. Physical and Other Hazards	11
PATHWAYS ANALYSES	11
A. Completed Exposure Pathways	13
1. Private Supply Well Pathway	13
2. Public Water Supply Pathways	14
B. Potential Exposure Pathways	15
1. Soil-gas Pathway	15
PUBLIC HEALTH IMPLICATIONS	15
A. Toxicological Evaluation	15
B. Health Outcome Data Evaluation	18
C. Community Health Concerns Evaluation	18
CONCLUSIONS	19
RECOMMENDATIONS	20
PUBLIC HEALTH ACTIONS	21
PREPARERS OF THE REPORT	23

CERTIFICATION 24

REFERENCES 25

APPENDIX 27

LIST OF ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
BETX	Benzene, Ethylbenzene, Toluene, Xylenes
CREG	Cancer Risk Evaluation Guides
DOH	Washington Department of Health
EMEG	Environmental Media Evaluation Guides
EPA	U.S. Environmental Protection Agency
HARP	ATSDR Health Activities Recommendation Panel
LOAEL	Lowest Observed Adverse Effect Level
MCL	Maximum Contaminant Level
MRL	Minimal Risk Level
ND	Not Detected
NOAEL	No Observed Adverse Effect Level
PCE	Tetrachloroethylene
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
TCE	Trichloroethylene
TRI	Toxic Chemical Release Inventory
VOC	Volatile Organic Compound
WS4	Vancouver Water Station No. 4
WS5	Vancouver Water Station No. 5

LIST OF UNITS OF MEASUREMENT

kg	Kilograms
µg/L	Micrograms per Liter
mg/kg/day	Milligrams per Kilograms per Day
ppm	Parts Per Million

SUMMARY

Vancouver Water Station No. 4 Superfund site (WS4) is a municipal well field located in the city of Vancouver, Clark County, Washington. The site poses no apparent health hazard to the known exposed population as a result of short-term exposure to elevated tetrachloroethylene (PCE) concentrations in water. Exposure to PCE has occurred in the past to residents, workers, and students supplied water from contaminated domestic supply wells, WS4 wells, and the State School for the Blind well. Residences with a contaminated domestic supply well and the State School for the Blind have been placed on the municipal water system, thus eliminating exposure to elevated PCE concentrations. Exposure to low concentrations of PCE may be currently occurring to people on the municipal water supply provided by WS4 wells. However, water from WS4 wells is treated to ensure that PCE concentrations in the public water supply meet Federal Safe Drinking Water Act requirements. Based on known exposure duration and exposed population, adverse health effects are unlikely to result from PCE exposure at concentrations observed in contaminated water.

However, all populations at risk to PCE exposure from contaminated private supply wells may not have been identified. A water well survey conducted during the 1989 investigation addressed only areas of suspected groundwater contamination associated with WS4. Later investigations indicate groundwater contamination outside the original exploration area for WS4. An inventory of private supply wells has not been conducted in these areas to determine the potentially exposed population. In addition, the extent and migration of groundwater contamination associated with WS4 is not well defined. PCE contamination of private supply wells may be occurring or may occur in the future.

After public notification of WS4 groundwater contamination, community health concerns were expressed by local citizens. The primary health concern was the cancer risk from exposure to PCE contaminated drinking water. A discussion of community health concerns is included in the Public Health Implication section of this Preliminary Public Health Assessment.

The Washington State Department of Health (DOH) and the Agency for Toxic Substances and Disease Registry (ATSDR) recommend 1) further characterization of the extent and migration of groundwater contamination associated with WS4; 2) identification of all private supply wells in vicinity of WS4; 3) monitoring all identified domestic supply wells and small public water supply wells in vicinity of WS4; 4) that additional data on groundwater and soil-gas be obtained.

The Health Activities Recommendation Panel (HARP) has determined that a community health education effort is needed to assist the community in understanding their potential for exposure. ATSDR in cooperation with DOH will assist the community in understanding public health implications posed by the Vancouver Water Station No. 4 Site. As additional data becomes available, DOH and ATSDR will reevaluate the site for necessary follow-up health activities.

BACKGROUND

This document is a Preliminary Public Health Assessment prepared for the Vancouver Water Station No. 4 Superfund site (WS4) by the Washington Department of Health (DOH) under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The purpose of this document is to evaluate data currently available for WS4 to determine the public health significance of the Superfund site.

A. Site Description and History

The site is approximately two miles east of Interstate Highway 5, at the southwest corner of East Fifth Street and Blandford Drive. WS4 consists of six production wells which were originally installed during WWII to provide water to workers at the Vancouver shipyards (Figure 1). WS4 serves the Mill Plain Boulevard and McLoughlin Heights area extending from Grand Boulevard east to Interstate Highway 205 and from Mill Plain Boulevard south to the Columbia River. Prior to discovery of groundwater contamination, WS4 provided approximately 25 percent of the city of Vancouver's water supply.

In March 1988, in response to the 1986 Federal Safe Drinking Water Act Amendments, the City of Vancouver, Public Works Department began monitoring the municipal water supply for volatile organic compounds (VOCs). Monitoring results revealed VOCs in wells at Water Station 1, 3, and 4. Tetrachloroethylene (PCE) was the only VOC detected in WS4 wells. Concentrations of PCE were found in all six wells. Four wells with the highest PCE concentrations were temporarily shut down, while two remained in production. The City of Vancouver, Public Works Department implemented a remedial action plan in an effort to keep concentrations of PCE in drinking water below the U.S. Environmental Protection Agency (EPA) Drinking Water Standard, proposed Maximum Contaminant Level (MCL) of 5 micrograms per liter ($\mu\text{g/L}$). Until remedial actions were completed, the DOH Drinking Water Program recommended the City of Vancouver, Public Works Department maintain concentrations of PCE in drinking water below the EPA Lifetime Health Advisory guideline of 10 $\mu\text{g/L}$.

During February 1989, the City of Vancouver, Public Works Department notified the public of the VOC monitoring results for WS4. Public notification also included a presentation by DOH Drinking Water Program regarding health implications from domestic use of PCE contaminated water. In late February 1989, the City of Vancouver, Public Works Department contracted a consulting firm to investigate potential sources of PCE contamination and to determine the extent of contamination associated with WS4. Subsequently, in October 1989, due to increasing PCE concentrations, production of all WS4 wells was shut down. Based on existing groundwater data, WS4 was proposed for the National Priorities List for hazardous waste sites to be investigated under Superfund on July 26, 1991. The designation of WS4 as a Superfund site was finalized in October 1992.

To treat PCE contaminated groundwater, the City of Vancouver, Public Works Department installed two air stripping towers at WS4. This remedial action brought groundwater under compliance with the Federal Safe Drinking Water requirements. Early in 1992, approximately 50 percent of WS4 water production capacity was resumed.

B. Site Visit

A site visit of WS4 was conducted on January 28, 1992, by Anne Duffy and Jim White of the DOH Hazardous Waste Section. WS4 is situated on a river terrace north of the Lewis and Clark Highway. WS4 is completely enclosed by a chain-linked fence and landscaped. Within the fenced area are two air stripping towers, a large building which contains well lines that connect to the air stripping towers, and several smaller buildings containing well pumps. During the site visit, construction crews were working on the air stripping towers, as well as the adjacent buildings.

Lewis and Clark Highway and the Columbia Business Center are located south of WS4. A motel is directly northeast on the corner of Blandford Drive and Lewis and Clark Highway. East Fifth Street and the base of another river terrace are located north of the site. The Blandford Canyon, a small ravine, and an utility easement cut into this upper terrace running north to northeast.

Located on this upper terrace is a residential area bounded to the north by Evergreen Boulevard. Several contaminated domestic supply wells exist in the area; wells at 4701 East Evergreen Boulevard near a trailer park, at 3808 East Clark Avenue, and on Wauna Vista Drive. Located east of WS4 is a nursing center and several apartment complexes on East Fifth Street and on Columbia View Drive. The Harney Elementary School is located northwest of WS4 on the corner of Evergreen Boulevard and Grove Street.

Investigations of WS4 suggest three dry cleaning establishments may be sources of groundwater contamination. A visit to the location of these suspected contamination sources was conducted. The two dry cleaning establishments still in operation are located on Mill Plain Boulevard at Tower Mall shopping center and west of Park Hill Cemetery. The third dry cleaning establishment has been closed since the late 1950s. The location of this former cleaners is on Devine Street, west of Park Hill Cemetery and southeast of Tower Mall shopping center. At these locations, there was no obvious indication of improper disposal of PCE solvent outside the present buildings.

C. Demographics, Land Use, and Natural Resource Use

Approximately 47,190 people live in Vancouver, Washington. The city of Vancouver is characterized by residential neighborhoods, and is bisected north to south by Interstate Highway 5 creating a corridor of light-industrial development.

Land use surrounding WS4 is characterized as single and multi-family residences, as well as small commercial businesses to the west, north, and east. The area south and west includes commercial and industrial facilities in the Columbia Business Center and near the Pearson airport. Tower Mall shopping center is approximately 1/2 mile northeast of WS4 at the head of Blandford Canyon. Directly west of WS4 is the former site of Boss Farms. Several residences still exist on the Boss Farms site, but the majority of the area consists of unused fields. A construction debris landfill occupies a portion of the field area approximately 1/2 mile to the west, bounded by Grove Street. Residences, apartments, and the Rose Vista Nursing Center are located east of WS4 on East Fifth Street and on Columbia View Drive.

Several schools are located within approximately a one-mile radius of WS4: Harney Elementary School, Fort Vancouver High School, Hudson's Bay High School, Clark College, State School for the Deaf, and the State School for the Blind.

The population uses groundwater from either public water systems or private supply wells. WS4 supplies water to the Mill Plain Boulevard and McLoughlin Heights area extending from Grand Boulevard east to Interstate Highway 205, and from Mill Plain Boulevard south to the Columbia River. Prior to discovery of groundwater contamination, WS4 served an estimated population of 30,000. With WS4 operating at 50 percent capacity, the current population served is estimated at 16,000 (19).

A supply well at the State School for the Blind served as a small public water system supplying water for approximately 150 school students and employees. In May 1992, the State School for the Blind reconnected to the municipal water system for their water supply. The State School for the Blind no longer uses the supply well for drinking water or other purposes. The depth of the well is about 220 feet and the aquifer accessed has not been defined in available groundwater investigations.

During the 1989 investigation, a survey was conducted to identify existing water wells in the exploration area of WS4 suitable for sampling (11). Twenty-eight private supply wells were identified. Fourteen of these wells were used as domestic supply wells for single-family residences. The well depths ranging from 11 feet to 396 feet and access either the Orchards or Upper Troutdale Formation aquifers. The exploration area included areas immediately surrounding and approximately a half mile north/northeast of WS4. Since the water well survey was limited, it is possible not all private supply wells have been identified.

WS4 wells and several private supply wells draw water from the unconfined Orchards aquifer. Recharge for the Orchards aquifer near WS4 appears to be from infiltration of precipitation and the Columbia River. The primary recharge area is north and east of WS4. Directly north of WS4, Orchards aquifer interfaces with the Upper Troutdale Formation aquifer. The Orchards aquifer consists of alluvial deposits unevenly overlying the Troutdale Formation. The Upper Troutdale Formation aquifer supplies water for many private supply wells in the Mill Plain Boulevard and McLoughlin Heights area. The Upper Troutdale Formation aquifer consists of deposits similar to the Orchards aquifer but more well cemented.

Generally, groundwater flow of both the Orchards and Upper Troutdale Formation aquifers is towards the southwest. West and possibly at WS4, groundwater appears connected to and influenced by the Columbia River to the south. East of Andresen Drive, groundwater flows south and perpendicular to the Columbia River (12).

A series of well-defined river terraces rise to the north of the Columbia River near WS4. Surface water on these terraces is minimal because of numerous springs and an existing drainage system. The drainage system consists of catch basins feeding dry wells which are interconnected in places draining storm water runoff from the upper terraces. Blandford Canyon is the largest surface water transport feature cutting the south face of the terraces. This canyon drains runoff from the Tower Mall area and carries surface water to fields located west of WS4. The WS4 investigation report mentions an artificial lake located at 5555 East Evergreen Boulevard (11).

D. Health Outcome Data

This section identifies relevant health outcome data available for the state of Washington. Using health outcome databases, it may be possible to determine whether the occurrence of certain health outcomes is more frequent than expected in Clark County, Washington. Since the health outcome of cancer is a community health concern, cancer registries were identified.

Washington State maintains three cancer registries, the Cancer Surveillance System, Spokane Central Registry, and Washington State Cancer Registry. Presently, no cancer health outcome data exist for Clark County. The Cancer Surveillance System and Spokane Central Registry do not include health outcome data from Clark County. The new Washington State Cancer Registry consists of incident cases as of January 1992; however, portions of southwest Washington are not covered by the new registry, including Clark County.

COMMUNITY HEALTH CONCERNS

In February 1989, the City of Vancouver, Public Works Department notified the public of PCE contamination at WS4 during a City Council meeting. In response to public notification, the City of Vancouver, Public Works Department received 373 phone calls between February 7, 1989, and February 9, 1990. From conversations with the City of Vancouver, Public Works Department and DOH Drinking Water Program, the main community health concern is the risk of cancer from drinking water contaminated with PCE.

The public was officially invited to comment on the draft Preliminary Public Health Assessment for Vancouver Water Station No. 4 Superfund site, November 16, 1992 through December 18, 1992. For public review, the document was made available at the Fort Vancouver Regional Library, in Vancouver. As of January 3, 1993, DOH had not received any public comments.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

Listed in the tables of this section are contaminants of concern associated with the Vancouver Water Station No. 4 Superfund site. Contaminants of concern are selected from sampling data by comparing the maximum contaminant concentrations to comparison values, Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant health-based guidelines. Contaminants of concern are not necessarily contaminants that will cause adverse health effects from exposures, rather contaminants that will be evaluated further in the Public Health Implications section of this Preliminary Public Health Assessment.

EMEGs are estimated contaminant concentrations at which daily exposure would be unlikely to result in noncarcinogenic health effects. The oral EMEG for drinking water exposure is calculated from ATSDR Minimal Risk Levels (MRLs), based on a child body weight of 10 kilograms (kg), and a child water consumption rate of one liter per day. ATSDR developed MRLs to evaluate health effects of contaminants commonly found at hazardous waste sites. MRLs are estimates of daily exposure to contaminants below which noncarcinogenic adverse health effects are unlikely to occur. If MRLs do not exist for a specific contaminant, a comparison value is calculated from EPA Reference Dose (RfD). A RfD is an estimate of daily exposure to a contaminant that is unlikely to cause a noncarcinogenic adverse health effect.

CREGs are estimated contaminant concentrations at which exposure would unlikely result in more than one excess cancer in one million persons exposed for a lifetime of 70 years. CREGs for drinking water exposure are calculated from EPA cancer slope factors, based on an adult body weight of 70 kg, and an adult water consumption of two liters per day.

To identify possible facilities that could contribute to the groundwater contamination near the Vancouver Water Station No. 4, DOH searched the Toxic Chemical Release Inventory (TRI) Database for all available years (1987, 1988, and 1989). TRI is developed by the EPA from information about chemical releases to air, water, or soil, as provided by industries according to law. TRI did not contain records of any PCE releases in Vancouver, Clark County, Washington.

A. On-Site Contamination

1. Groundwater - Vancouver Water Station No. 4 Wells

In March 1989, one groundwater sample from WS4 - Well 6B was analyzed for halogenated and aromatic volatile organic compounds (11). In 1990, two samples from WS4 - Well 2B were analyzed for halogenated and aromatic volatile organic compounds (12, 13). Tetrachloroethylene (PCE) was the only compound detected. Well 6B had a PCE concentration of 9.3 micrograms per liter ($\mu\text{g/L}$) and Well 2B had PCE concentrations of 3.4 $\mu\text{g/L}$ and 5.6 $\mu\text{g/L}$.

From May 1989 through August 1991, monthly samples from WS4 - Wells 2B and 5, were collected and analyzed for PCE (5, 12). Results indicated PCE concentrations from Well 2B ranged from 0.98 $\mu\text{g/L}$ to 25.0 $\mu\text{g/L}$ and from Well 5 ranged from 0.24 $\mu\text{g/L}$ to 11.0 $\mu\text{g/L}$. Table

1 summarizes the PCE concentration range detected in the WS4 wells sampled March 1989 through August 1991 (Figure 1).

TABLE 1
Range of Contaminant Concentrations in On-Site Groundwater Samples

Contaminant	Concentration Range - µg/L	Comparison Value	
		µg/L	Source
PCE	0.24 - 25.0	100	* RfD

* Comparison value for a child's exposure based on RfD
References - 5, 11, 12, and 13

B. Off-Site Contamination

1. Groundwater - Private Supply Wells/Project Monitoring Wells

In March 1989, groundwater samples were collected from 28 private supply wells in the vicinity of WS4 and analyzed for halogenated and aromatic volatile organic compounds (11). Private wells sampled were domestic supply wells, former domestic supply wells, irrigation wells, heat exchange system water wells, and monitoring wells. Results indicated that PCE was the only compound detected ranging from Not Detected (ND) to 55 µg/L.

In order to obtain information on groundwater contamination, seven project monitoring wells were installed off-site at four separate locations. Two wells were located at the northwest corner of Harney Elementary School property on Grove Street and Edgewood Drive, two wells were located at the southeast corner of DuBois Park on Palo Alto Drive and Phoenix Way, two wells were located on East Fifth Street east of Grove Street, and one well was located on the central part of Park Hill Cemetery south of Mill Plain Boulevard. The two monitoring wells on East Fifth Street access the Orchards aquifer, and the other wells access the Upper Troutdale Formation aquifer.

In Spring 1990, groundwater samples were collected from seven project monitoring wells, as well as ten private wells. Samples were analyzed for halogenated and aromatic volatile organic compounds. In addition, five of these samples were analyzed for nitrates, and two were analyzed for total dissolved metals.

Besides PCE, results indicated concentrations of benzene, ethylbenzene, toluene, and xylenes (BETX) at two project monitoring wells on East Fifth Street east of Grove Street. Contaminants were only detected during the third round of groundwater samples collected from the two wells. BETX are known constituents of gasoline. The city of Vancouver reported that during repair of East Fifth Street, following the installation of the two monitoring wells, gasoline was used to clean shovels. This gasoline could have been rinsed into the well vault and introduced into the well when the well cap was removed. Subsequent groundwater sampling did not analyze for aromatic volatile organic compounds, therefore it is not known if BETX concentrations still exist at the two monitoring wells (12).

In December 1990, groundwater samples were collected from project monitoring wells and seven private wells. In August 1991, samples were collected from project monitoring wells and nine private wells. Groundwater samples were analyzed for halogenated volatile organic compounds (13, 15).

Based on the sampling results, PCE concentrations have increased significantly from <0.2 µg/L in May 1990 to 795 µg/L in August 1991 at a former domestic supply well. The well is located at 4701 East Evergreen Boulevard approximately 1,000 feet upgradient of WS4. Further groundwater investigations of the well, August 1991 through January 1992, indicate that PCE concentrations continued to increase. The maximum concentration of PCE detected is 1,510 µg/L (6). Table 2 summarizes the contaminants detected and concentration ranges determined during off-site groundwater sampling of the project monitoring and private wells.

TABLE 2
Range of Contaminant Concentrations in Off-Site Groundwater Samples

Contaminant	Concentration Range - µg/L	Comparison Value	
		µg/L	Source
Benzene	ND - 6.6	1.2	CREG
PCE	ND - 1,510	100	* RfD

* Comparison value for child's exposure based on RfD

ND - Not Detected

References - 6, 13, and 15

2. Surface Water

Three surface water samples were collected in March 1989 from Blandford Drive ravine, a spring/sump at 5555 East Evergreen Boulevard, and Highway Department piezometer 13 area.

Samples were analyzed for halogenated and aromatic volatile organic compounds (11). PCE was only detected at the spring/sump at 3.9 µg/L. Later in April 1990, the spring/sump was resampled and results indicated a PCE concentration of 3.3 µg/L (12).

Two industrial sumps, Sump 1 at 3000 Lewis and Clark Highway and Sump 2 at 4200 Columbia Way were also sampled in March 1989. PCE was not detected at Sump 1, however a PCE concentration of 6.6 µg/L was detected at Sump 2. During off-site surface water sampling, PCE was the only compound detected. The range of PCE concentrations is shown in Table 3.

TABLE 3
Range of Contaminant Concentrations in Off-Site Surface Water Samples

Contaminant	Concentration Range - µg/L	Comparison Value	
		µg/L	Source
PCE	ND - 6.6	100	* RfD

* Comparison value for child's exposure based on RfD

ND - Not Detected

References - 11 and 12

3. Soil-gas

In 1989, to identify the source of PCE contamination, a soil-gas survey was conducted northeast of WS4 in the Evergreen terrace area, the area around Mill Plain Boulevard and Devine Road, and the Park Hill Cemetery area. A total of 93 gas samples were collected, 70 soil-gas samples from shallow vadose zone and 23 gas samples from catch basins. Of the soil-gas samples, 67 samples were collected at three feet deep, two at six feet, and one at nine feet. Gas samples were analyzed for PCE, as well as other VOCs (11). Results indicate PCE concentrations ranged from ND to >0.064 parts per million (ppm).

Later in 1989, two soil-gas surveys were conducted at the State School for the Deaf located on Grand and Evergreen Boulevards and near a former domestic supply well at 3105 Northeast 66th Avenue on Fourth Plain Boulevard and Andresen Road (14). The soil-gas survey at the State School for the Deaf was conducted due to reports of past dumping of PCE solvents in the area. The area near the former domestic supply well was selected for a soil-gas survey because of known PCE-contamination in the well. Results from both survey areas indicate contaminant concentrations above background levels for PCE and trichloroethylene (TCE). The State School

for the Deaf survey found PCE concentrations near or below detection levels in four of five soil-gas samples and one sample at 0.001 ppm. TCE concentrations were found in all five samples ranging from 0.008 ppm to 0.026 ppm. The soil-gas survey near the well found two of ten samples with PCE concentrations at 0.0006 ppm and 0.004 ppm. TCE concentrations were found in all ten samples ranging 0.001 ppm to 0.027 ppm.

During installation of the seven project monitoring wells in 1990, soil-gas was screened for PCE, as well as other VOCs. PCE concentrations were detected near the detection level or less than 0.0006 ppm in all samples. TCE concentrations were found to range from below detection level to 0.01 ppm (14).

In 1991, soil-gas survey near the contaminated well at 4701 East Evergreen Boulevard was conducted to identify potential sources of PCE contamination nearby. Sixteen soil-gas samples were collected within a 150 foot radius of the wellhead. PCE concentrations in soil-gas were detected north and northeast of the well and directly south of the trailer park maintenance and operations buildings. PCE concentrations identified north and northeast of the well may be due to disposal of well water after purging during groundwater sampling. Concentrations ranged up to 0.046 ppm.

Listed below in Table 4 are contaminants detected and concentration ranges determined during off-site soil-gas sampling. Soil-gas surveys were unable to determine the source of PCE contamination related to groundwater contamination at WS4.

TABLE 4
Range of Contaminant Concentrations in Off-Site Gas Samples

Contaminant	Concentration Range - ppm	Comparison Value	
		ppm	Source
PCE	ND - >0.064	0.009	EMEG
TCE	ND - 0.027	None	None

Intermediate inhalation EMEG
References - 11 and 14

4. Soil

During installation of the seven project monitoring wells, soil samples from four well locations were analyzed for halogenated volatile organic and aromatic volatile organic compounds. There were no VOCs detected in off-site soil samples (11).

C. Quality Assurance and Quality Control

A Data Review Summary was not provided on the laboratory data used in investigation reports for Vancouver Water Station No. 4 Superfund site. This Preliminary Public Health Assessment relies upon information provided in referenced documents and assumes that adequate quality assurance and quality control measures were followed regarding chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and conclusions drawn by this Preliminary Public Health Assessment are dependent on the completeness and reliability of the reference information.

D. Physical and Other Hazards

No physical or other hazards are associated with Vancouver Water Station No. 4 Superfund site.

PATHWAYS ANALYSES

To determine whether people are exposed to contaminants associated with WS4, environmental and human components of the exposure pathways are evaluated. Pathway analysis consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of exposure, and an exposed population.

Exposure pathways are categorized as completed or potential. Completed exposure pathways require that the five elements exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or likely to occur in the future. Potential exposure pathways, however, indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated from consideration if at least one of the five elements is missing and will never be present. The following section discusses exposure pathways relevant to WS4. Table 5 identifies completed exposure pathways and Table 6 identifies potential exposure pathways.

TABLE 5. COMPLETED EXPOSURE PATHWAYS

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Private Supply Wells	Groundwater	Groundwater (Domestic Supply Wells)	Residences (tap)	Ingestion and Inhalation	Residents Using Contaminated Wells	Past Present Future
Public Water Systems	Groundwater	Groundwater (WS4 and State School for the Blind)	Residences, Businesses, and School (tap)	Ingestion and Inhalation	Residents, Workers, and School Students and Employees Using These Public Water Supplies	Past Present Future

TABLE 6. POTENTIAL EXPOSURE PATHWAY

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Soil-gas	Soil-gas	Indoor Air	Residences, Schools, Business and Commercial Buildings	Inhalation	Residents, Students, and Workers	Past Present Future

A. Completed Exposure Pathways

PCE and benzene were selected as contaminants of concern for groundwater. However, PCE is the only contaminant known to exist in the completed exposure pathways. Benzene was not detected in groundwater associated with private wells or public water supply pathways. Therefore, the focus of completed exposure pathways will be on PCE as the contaminant of concern.

1. Private Supply Well Pathway

Past, present, and future exposure from contaminated groundwater in private wells used as domestic supply wells represents a completed exposure pathway.

The actual source of groundwater contamination associated with WS4 is not known. In 1989, fourteen residences with domestic supply wells accessing the Upper Troutdale Formation or Orchards aquifers were identified. PCE contamination was discovered in seven wells at concentrations ranging up to 55 µg/L. At two of the residences, water from the contaminated wells was not used for drinking water. Five other residences with contaminated wells have been connected to the municipal water system. However, it is not known if these residents still use or can access water from the contaminated wells for domestic purposes other than drinking water.

The seven domestic supply wells, where PCE contamination was not detected, have never been resampled. Investigations indicate widespread PCE contamination in groundwater; however the extent and migration of groundwater contamination is not well defined. In addition, PCE concentrations are increasing in several of the known contaminated wells. If groundwater contamination migrates to these seven domestic supply wells, a completed exposure pathway may currently be occurring or may occur in the future.

The water well survey was confined to WS4 exploration area determined in the 1989 investigation. The exploration area includes the immediate site vicinity and extends north/northeast approximately a half mile from the site. Later, PCE contamination was detected outside this area in wells at Clark Community College and the State School for the Blind located approximately one mile northwest of WS4. It is not known if other private wells exist northwest of WS4. A comprehensive inventory of private supply wells and sampling is necessary to evaluate potential past, current, and future exposure to PCE contaminated drinking water.

Residents using contaminated water for domestic purposes may be exposed to PCE through ingestion of drinking water and inhalation of water vapors. Inhalation exposure can occur as PCE volatilizes from contaminated water into indoor air during household activities such as showering, bathing, or dishwashing. Private wells used for irrigation were also determined to be contaminated. Inhalation exposure to PCE may occur as irrigation water volatilizes into ambient air. However, this exposure is considered to be minimal due to environmental factors such as the dilution of PCE concentrations by an immense volume of air, and wind direction and

velocity. PCE does not readily pass through the skin, therefore dermal contact is not considered a significant route of exposure.

2. Public Water Supply Pathways

Past, present, and future exposures from contaminated groundwater in public water systems represent completed exposure pathways.

In 1988, City of Vancouver, Public Works Department began monitoring for VOCs in the municipal water system in order to comply with new requirements of the Federal Safe Drinking Water Act Amendments of 1986. PCE concentrations in the municipal water supply from WS4 ranged from 3 to 9 µg/L. WS4 wells draw water from the Orchards aquifer and pump water directly into distribution lines to local residences. Water can also be transferred to an eight million gallon ground reservoir and 0.75 million gallon elevated tank at Water Station No. 5 (WS5) on Mill Plain Boulevard and Devine Road. Water from WS5 reservoir and tank is distributed to local residences and businesses. Since early 1992, groundwater from WS4 wells has been treated prior to distribution to ensure a public water supply which meets the safe drinking water standards.

In the past, WS4 served an estimated 30,000 people. Past exposure by this population to a specific concentration of PCE is unknown; however, exposure is expected to be lower than the PCE concentrations found in the municipal water system prior to distribution. Volatilization of PCE from water can occur during transfer through distribution lines, as well as during storage at WS5 reservoir and tank. To determine past exposure of residents and workers, water samples need to have been collected at the point of exposure, the drinking water tap.

The population currently served by WS4 is estimated at 16,000. Present and future exposure by this population to PCE is likely through the municipal water supply. However, the municipal water supply from WS4 is treated and resulting PCE concentrations have been below the EPA MCL of 5 µg/L prior to distribution. Present and future exposure to PCE is expected to be lower than the PCE concentrations in the municipal water system prior to distribution. Again, water samples need to be collected at the point of exposure, the drinking water tap, to determine present exposure of residents and workers to PCE.

On January 5, 1989, DOH Drinking Water Program monitored for VOCs in the supply well at the State School for the Blind. No contaminants were detected. However, during the 1991 investigation, a sample from the well detected a PCE concentration of 3 µg/L. Four samples collected in April and May 1992 indicated PCE concentrations ranging from 9.7 to 15 µg/L (23). DOH Drinking Water Program required the State School for the Blind to ensure a public water supply which meets the safe drinking water standards. In late May 1992, the State School for the Blind reconnected to the municipal water system for their water supply.

The school well was used for domestic and irrigation purposes and served approximately 150 people. Past exposure by these people to PCE is likely to have occurred. The duration of

exposure may have been up to three years to PCE concentrations ranging up to 15 µg/L. Of these people, 70 are students, 50 of whom are residents during the school year and 20 who are only present during a normal school day. The remaining number of people are school employees (23). Students at the State School for the Blind may have additional health problems associated with their handicaps, and, therefore, represent a population likely to be at a higher health risk to PCE exposure.

Residents, students, and workers using contaminated water supplied by either WS4 or the State School for the Blind well may be exposed to PCE through ingestion and inhalation exposure routes.

B. Potential Exposure Pathways

1. Soil-gas Pathway

Past, present, and future exposure from contaminated soil-gas migrating into indoor air of nearby residences, school, or business buildings represents a potential exposure pathway.

Soil-gas surveys reveal PCE and TCE concentrations above background levels. The source of soil-gas contamination is unknown. Soil-gas contaminants can migrate through porous soil directly into the atmosphere or into confined spaces of nearby buildings through foundation cracks, plumbing holes, and crawl spaces. Soil-gas contaminants can concentrate in these confined spaces, contaminating indoor air. People may be exposed through inhalation to contaminated indoor air. Actual exposure to PCE and TCE by residents, workers, and students to indoor air of nearby buildings is not known. To determine if the soil-gas pathway is completed, additional soil-gas and indoor air sampling is necessary.

PUBLIC HEALTH IMPLICATIONS

A. Toxicological Evaluation

Tetrachloroethylene (PCE)

Adults or children using contaminated water supplied by contaminated domestic supply wells, WS4 wells, or the State School for the Blind well are exposed to PCE through a completed exposure pathway. PCE exposure can occur through ingestion of drinking water and inhalation of water vapors during activities such as showering and bathing.

In order to assess health effects which could result from exposure to contaminated water, a daily contaminant dose which people may receive was calculated. Exposure from inhalation is assumed to be equivalent to exposure from ingestion. Health-based guidelines for PCE exposure are compared to estimated daily exposure doses to evaluate noncarcinogenic health effects. EPA derived an oral RfD for chronic oral exposure to PCE of 0.01 milligrams per kilogram of body

weight per day (mg/kg/day). ATSDR developed an oral MRL for an intermediate exposure duration (15-365 days) of 0.1 mg/kg/day (2).

The estimated daily exposure dose calculated for an adult and a child from the maximum PCE concentration (50 µg/L) in domestic supply wells used for a drinking water source does not exceed the RfD for chronic exposure or the MRL for intermediate exposure duration. Therefore, residents using contaminated water at the maximum PCE concentration are unlikely to experience adverse noncarcinogenic health effects.

The estimated daily exposure doses calculated from the maximum PCE concentration (9 µg/L) in the municipal water supply provided by WS4 wells and from the maximum PCE concentration (15 µg/L) in the State School for the Blind water supply, also do not exceed the chronic RfD or intermediate MRL for adults or children. Local residents, workers, and students using contaminated water at the maximum PCE concentrations are unlikely to experience adverse noncarcinogenic health effects.

The private supply well at 4701 East Evergreen Boulevard, a former domestic supply well, has significantly elevated PCE concentrations (1,510 µg/L). There is no known human exposure to water from this well. However, should PCE migrate at these levels to nearby private wells, residents could be exposed to high PCE concentrations. Estimated daily exposure doses calculated from PCE concentrations observed in the Evergreen Boulevard well exceed the RfD for chronic exposure for adults and children and the MRL for intermediate exposure for children.

RfDs and MRLs are developed to include safety and uncertainty factors. To evaluate possible health effects, estimated daily exposure doses exceeding RfDs and MRLs are compared to exposure levels (NOAELs) below which no adverse health effects have been observed or to lowest exposure levels (LOAELs) at which adverse health effects have been observed in experimental studies (2). Data from human studies is used preferentially, but animal studies can be used to indicate possible human health effects. Estimated daily exposure doses are well below the NOAEL in animals of 20 mg/kg/day for intermediate exposure and the LOAEL for serious health effects in animals of 386 mg/kg/day for chronic exposure. Therefore, adults and children are unlikely to experience adverse noncarcinogenic health effects at estimated daily exposure doses calculated from the maximum PCE concentration (1,510 µg/L) in the contaminated Evergreen Boulevard well.

The carcinogenicity of PCE is currently under review by EPA. No human studies exist which determine conclusively that PCE causes cancer (2). A decision as to whether PCE should be classified as a probable human carcinogen (EPA Group B2) based on evidence from animal studies, or as a possible carcinogen (EPA Group C) is pending. The International Agency for Research on Cancer classifies PCE as a possible human carcinogen (2). The assessment of carcinogenicity is based on exposure over a lifetime of 70 years. The likelihood of developing cancer as a result of lifetime exposure to PCE found in contaminated water associated with WS4 cannot be estimated based on the information currently available.

Short-term exposure through completed exposure pathways from domestic supply wells and public water systems does not represent a health concern for noncarcinogenic health effects. Future short-term exposure to concentrations of PCE observed in the well at 4701 East Evergreen Boulevard is also unlikely to cause health effects. Long-term exposure to PCE may result in carcinogenic effects; however, the designation of PCE as a probable human carcinogen has not been made. The magnitude of the risk of cancer following exposure to PCE is unknown based on current information. Uncertainties are noted in the exposure evaluation. PCE concentrations are increasing, particularly at the Evergreen Boulevard and WS4 wells. Not all private wells within a one-mile radius of WS4, particularly northwest, have been identified. It is possible that exposure to contaminated water is occurring. Also, the migration of groundwater contamination in the area is not well understood. Domestic supply wells where PCE was not detected during the 1989 investigation could become contaminated in the future.

Inhalation exposure by residents and workers to PCE represents a potential exposure pathway. Several soil-gas samples detected concentrations above the comparison value for PCE. These samples were located near Clark Street and Harney Street, Park Hill Cemetery, MacArthur Boulevard and Alabama Drive, and the well at 4701 East Evergreen Boulevard. The NOAEL for observed health effects in humans is estimated at 20 ppm for acute (14 days or less) and chronic exposure to PCE. It is unlikely that soil-gas with PCE concentrations observed near Clark Street and Harney Street (0.011 ppm), Park Cemetery Hill (0.010 ppm), and East Evergreen Boulevard (0.046 ppm) could migrate to nearby buildings and accumulate to concentrations contaminating indoor air above the NOAEL. Therefore, nearby residents and workers are unlikely to be exposed to PCE concentrations that would result in noncarcinogenic health effects. However, three soil-gas samples collected near MacArthur Boulevard and Alabama Drive had concentrations exceeding maximum concentration limits of laboratory equipment. Health effects cannot be determined because actual concentrations of these soil-gas samples are unknown, and it is not known if the exposure pathway is complete.

Trichloroethylene (TCE)

Inhalation exposure by residences, students, and workers to TCE represents a potential exposure pathway. Soil-gas surveys of the State School for the Deaf and the well at 3105 Northeast 66th Avenue found TCE concentrations at 0.026 ppm and 0.027 ppm. In evaluating health effects, the concentrations were compared to NOAELS and LOAELs for TCE. The LOAEL in humans is estimated at 27 ppm, at which people have experienced eye, nose, and throat irritation, and drowsiness during acute exposure (3). It is unlikely that soil-gas concentrations will migrate and accumulate in nearby buildings to concentrations contaminating indoor air to the LOAEL. Therefore, residences, students, or workers are unlikely to be exposed to TCE concentrations that would result in any noncarcinogenic health effects.

No human studies exist that conclusively determine whether TCE causes cancer in humans (3). Although animal studies indicate increases in types of cancer following inhalation exposure to TCE, it is difficult to conclude TCE is an animal carcinogen. EPA classified TCE as probable human carcinogen, based on sufficient evidence in animal studies (3). EPA used cancer data on

male and female mice generated from 1982 and 1986 National Toxicological Program studies as a basis for the classification. EPA has recently withdrawn this classification while conducting a review of the carcinogenicity of TCE.

Although evidence from animal studies suggest TCE may be associated with liver and kidney cancer in rodents, evidence is inconclusive (3). Until additional experimental evidence is available, from either human or animal studies, we cannot determine if inhalation exposure to TCE is likely to cause cancer.

B. Health Outcome Data Evaluation

State cancer registries do not contain health outcome data from Clark County, Washington, where the Vancouver Water Station No. 4 site is located.

C. Community Health Concerns Evaluation

The one identified community health concern is addressed as follows: What is the risk of cancer from drinking water contaminated with PCE?

Ingestion and inhalation exposure by local citizens to PCE has occurred through the use of contaminated water supplied by WS4 wells, domestic supply wells, and the State School for the Blind well. Human studies do not conclusively demonstrate PCE causes cancer. PCE is currently under review by EPA to determine whether the compound should be classified as a probable human carcinogen based on evidence from animal studies, or as a possible human carcinogen. Health information currently available is inadequate to determine the likelihood of developing cancer as a result of lifetime exposure to PCE at concentrations observed in contaminated water associated with the WS4 site.

CONCLUSIONS

Vancouver Water Station No. 4 Superfund site poses no apparent public health hazard to the known exposed population as a result of short-term exposure to elevated PCE concentrations in water. Ingestion and inhalation exposure to PCE has occurred in the past to residents, workers, and students supplied water from contaminated domestic supply wells, WS4 wells, and the State School for the Blind well. Residences with a contaminated domestic supply well and the State School for the Blind have been placed on the municipal water system, thus eliminating exposure to elevated PCE concentrations. Exposure to low concentrations of PCE may be currently occurring to people on the municipal water supply provided by WS4 wells. However, water from WS4 wells is treated to ensure that PCE concentrations in the public water supply meet Federal Safe Drinking Water Act requirements. Based on known exposure duration and exposed population, adverse health effects are unlikely to result from PCE concentrations observed in contaminated water associated with WS4.

However, all populations potentially at risk of PCE exposure from contaminated water in private supply wells may not have been identified. The 1989 water well survey addressed only areas of suspected groundwater contamination. Later investigations indicate groundwater contamination outside WS4 original area of exploration. A private supply well inventory has not been conducted in these areas to determine the potentially exposed population. Only after the identification of private supply wells and the well water is analyzed, can PCE exposure and health implications of exposure be determined.

Existing data is insufficient to adequately characterize the extent and migration of groundwater contamination. Therefore, it is not known if other private supply wells in the area are currently impacted or will be impacted in the future. It is uncertain whether groundwater contamination has migrated to domestic supply wells identified in 1989 where PCE was not detected. To determine potential PCE exposure by residents and workers using these wells and health implications of exposure, resampling of the wells is necessary.

Data on groundwater contamination is insufficient for the two project monitoring wells on East Fifth Street east of Grove Street. Aromatic volatile organic compounds (BETX) were detected in the wells; however, subsequent sampling did not analyze for aromatic volatile organic compounds. Unless BETX contamination is confirmed, the potential for BETX exposure cannot be determined.

Data on soil-gas is insufficient near MacArthur Boulevard and Alabama Drive. PCE concentrations in three soil-gas samples exceeded the maximum concentration limits of laboratory equipment. Unless PCE soil-gas concentrations are identified, public health implications of exposure to levels of PCE present in soil-gas cannot be determined.

RECOMMENDATIONS

1. Conduct a private supply well inventory to identify potentially exposed population within a one-mile radius of WS4.
2. Conduct periodic monitoring private wells to determine if exposure to PCE or other hazardous substances is occurring at levels of public health concern. Monitoring data should be given to DOH and ATSDR for review.
3. Notify the public using private wells of potential exposure to contaminated groundwater.
4. Further characterize the extent and migration of groundwater contamination associated with WS4.
5. Resample groundwater in the two project monitoring wells on East Fifth Street east of Grove Street for aromatic volatile organic compounds (particularly BETX) to verify benzene or other hazardous substances are below levels of public health concern.
6. Resample soil-gas near MacArthur Boulevard and Alabama Drive to verify PCE concentrations are below levels of public health concern.

Health Activities Recommendation Panel Recommendations

The data and information developed in the Preliminary Public Health Assessment for the Vancouver Water Station No. 4 Superfund site have been evaluated by the ATSDR Health Activities Recommendation Panel (HARP) for follow-up health actions. Although people are exposed to site-related contaminants, known exposures are at levels that would not be expected to cause illness or disease. However, because the nature and extent of groundwater contamination is not well defined, nor is it certain all private wells have been identified, additional data is necessary to confirm the risk to people's health posed by site-related contaminants. To assist the community in understanding the potential for exposure, a community health education effort is ongoing and will continue. As additional groundwater data becomes available, DOH and ATSDR will reevaluate the site for necessary follow-up health activities.

PUBLIC HEALTH ACTIONS

Based on recommendations from the Preliminary Public Health Assessment for the Vancouver Water Station No. 4 Superfund site and HARP, ATSDR has developed the following public health actions which ATSDR, in cooperation with the DOH, will conduct.

1. As additional environmental data becomes available, ATSDR will re-evaluate the Vancouver Water Station No. 4 Superfund site for necessary follow-up health activities.
2. ATSDR will assist the community in understanding public health implications posed by the Vancouver Water Station No. 4 Superfund site.

Furthermore, the EPA Region 10 has conducted or will be conducting the following actions in response to recommendations concluded in the Preliminary Public Health Assessment for the Vancouver Water Station No. Superfund 4 site:

1. EPA conducted a private supply well survey of residences and businesses within a one-mile radius of WS4 in September 1992. The purpose of the survey is to identify the potentially exposed population to groundwater contamination associated with WS4. Survey fliers were mailed to approximately 8,000 residences and businesses requesting people to notify EPA of existing private supply wells. Also, the survey requested permission for EPA to sample water from identified private supply wells. Survey information is currently being compiled.
2. EPA will monitor the identified private supply wells used as a drinking water source to ensure groundwater contamination is below levels of public health concern. This groundwater monitoring will be conducted as part of EPA's investigation of WS4.
3. EPA notified people of residences and businesses within a one-mile radius of WS4, of potential exposure to groundwater contamination. This notification was conducted as part of the private supply well survey. As groundwater monitoring of identified private supply wells is conducted, EPA in cooperation with ATSDR, will provide monitoring results to well owners with an explanation of potential health implications posed by groundwater exposure.
4. EPA will further characterize the nature and extent of contamination during the Remedial Investigation/Feasibility Study (RI/FS) for Vancouver Water Station No. 4 Superfund site. The RI/FS is currently being developed. In August 1992, EPA began a limited investigation involving the installation of nine groundwater monitoring wells in the vicinity of WS4. The full field investigation of the RI/FS is anticipated for Spring 1993.
5. EPA will consider resampling the two project monitoring wells on East Fifth Street, if wells are still accessible. The wells may be included in the EPA groundwater monitoring program, which would analyze at least one round of groundwater sampling for all

compounds on the Target Compound List. This list includes the aromatic volatile organic compounds, BETX.

6. EPA will evaluate soil-gas data for contribution to WS4 contamination during the scoping process of the RI/FS. This evaluation will determine whether resampling of soil-gas will be conducted near MacArthur Boulevard and Alabama Drive.

PREPARERS OF THE REPORT

Anne Duffy
Public Health Advisor
Washington State Department of Health

Frank Westrum, R.S., M.S., M.P.H.
Supervisor, Hazardous Waste Section
Washington State Department of Health

ATSDR Regional Representative:

Greg Thomas
Regional Services
Office of the Assistant, Administrator, ATSDR

ATSDR Technical Project Officer:


Richard R. Kauffman, M.S.
Environmental Health Scientist
Remedial Programs Branch, State Programs Section
Division of Health Assessment and Consultation

CERTIFICATION

This public health assessment was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.


Technical Project Officer, SPS, RPB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment, and concurs with its findings.


Director, DHAC, ATSDR

REFERENCES

1. ATSDR. 1990 (Draft). Toxicological Profile for Tetrachloroethylene. US Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia.
2. ATSDR. 1992 (Draft). Update Toxicological Profile for Tetrachloroethylene. US Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia.
3. ATSDR. 1992 (Draft). Update Toxicological Profile for Trichloroethylene. US Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia.
4. City of Vancouver, Washington. April 1989. Blandford Water Station Remedial Action Plan. City of Vancouver, Department of Public Works, Vancouver, Washington.
5. City of Vancouver, Washington. October 1991. City of Vancouver Water Quality Data. PCE Concentration Data for Five Wells, May 1989 through September 1991.
6. City of Vancouver, Washington. January 1992. City of Vancouver Water Quality Data. Mercer Well Sampling Data, August 1991 through January 1992.
7. Dames and Moore, January 6, 1992. Draft Remedial Investigation Report Operable Unit A Volume I - Bonneville Power Administration Ross Complex. Prepared for Bonneville Power Administration Ross Complex, Vancouver, Washington.
8. Ecology and Environment, Inc. under USEPA Contract. February 1990. Volatile Organic Compounds Screening Results, Vancouver Soil Gas Study, Vancouver, Washington. Prepared for USEPA Region 10, Seattle, Washington.
9. Ecology and Environment, Inc. under USEPA Contract. April 1990. Vancouver Well Field Special Study, Vancouver, Washington. (Well Field 1 and 3) Prepared for USEPA Region 10, Seattle, Washington.
10. Ecology and Environment, Inc. under USEPA Contract. October 1991. Vancouver Well Field Study -Phase II, Vancouver, Washington. (Well Field 1) Prepared for USEPA Region 10, Seattle, Washington.
11. Rittenhouse-Zeman & Associates, Inc. July 1989. Final Report Groundwater Investigation, Water Station No. 4, City of Vancouver. Prepared for City of Vancouver, Washington.

12. Rittenhouse-Zeman & Associates, Inc. July 1990. Final Report (Phase II) Groundwater Investigation Water Station No. 4 City of Vancouver. Prepared for City of Vancouver, Washington.
13. Rittenhouse-Zeman & Associates, Inc. December 1990. Monitoring of Groundwater, Water Station No. 4 Vicinity, City of Vancouver, Washington. Prepared for City of Vancouver, Washington.
14. Rittenhouse-Zeman & Associates, Inc. January 1990. Final Report on Four Soil-Gas Surveys, City of Vancouver, Washington. Prepared for City of Vancouver, Washington.
15. Rittenhouse-Zeman & Associates, Inc. September 1991. Results of Recent Water Sampling Water Station #4 Vicinity, City of Vancouver, Washington. Prepared for City of Vancouver, Washington.
16. US Department of the Interior, Geological Survey. 1990. Quality of Water in Clark County, Washington, 1988. Prepared in cooperation with the Intergovernmental Resource Center of Clark County.
17. Washington Department of Health. January 1989. Health Consult Regarding The Presence of Unregulated VOCs in Three of the City of Vancouver's Well Fields. Washington Department of Health, Office of Toxic Substances, Olympia, Washington.

Personnel conversations:

18. City of Vancouver, Public Works Dept. Director, John Ostrowski. February 3 1992.
19. City of Vancouver, Public Works Dept. Water Quality Chemist, Pat Easley. January 1992 and October 30, 1992.
20. WDOH Office of Drinking Water, Section Head, Bill Liechty. January 31, 1992.
21. USEPA Region X, Toxicologist, Roseanne Lorenzana. February 3, 1992.
22. John Ostrowski, Public Works Dept. Director. Letter Subject: Public Concerns about PCE in Vancouver. February 4, 1992.
23. WDOH Office of Drinking Water, Water Quality Program Manager, Belle Fuchs. May 1992.

APPENDIX A

FIGURE 1 SITE LOCATION MAP

SITE LOCATION MAP



Columbia River

